1110-220 **QT Prolongation Is the Most Consistent Electrocardiographic Change Seen in Patients During Balloon Occlusion of the Coronary Artery With Percutaneous Coronary Intervention**

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Background
Prolongation of the QT interval (QT) has been described in patients with acute coronary syndromes, but not in patients undergoing percutaneous coronary intervention (PCI). We prospectively evaluated the presence of QT prolongation during PCI.
Methods
We recorded 15 lead ECGs at 20 second (s) intervals in patients undergoing elective PCI: 6 right coronary artery (RCA), 6 left circumflex artery (LCx) and 3 left anterior descending artery (LAD). In each ECG, we examined ST segment and T wave changes, QT, QTc interval (QTc) and QT dispersion (QTd, maximal QT - minimal QT).
Results
14 patients underwent 2 inflations, 9 underwent 3, and 7 underwent 4 inflations. The mean inflation times were 50 s, 57 s, 48 s, and 33 s during the 1st, 2nd, 3rd and 4th inflations, respectively. ST elevation, depression and T wave inversions were seen in 6, 2 and 3 patients, respectively. Prolongation of the QT , QTc and QTd were seen in all patients during each inflation, with a return to baseline after the inflation. QT, QTc and QTd prolonged on average by 24 ms, 37 ms, and 9 ms for the 1st inflation; 22 ms, 31 ms and16 ms for the 2nd inflation; 7 ms, 16 ms, 6 ms for the 3rd inflation; and 28 ms, 31 ms and 15 ms for the 4th inflation, respectively. In LAD PCI, QT prolongation was seen in V1-V6. In LCx PCI, QT prolongation was seen in II, III, aVF and V7-V9. In RCA PCI, it was seen in II, III, aVF, v3R and v4R.

	Baseline	Peak	p value
Mean QT (ms)	400 +/- 43.6	436.7 +/- 46.7	<.0001
Mean QTc (ms)	414.3 +/- 12.6	468 +/- 29.3	<.0001
Mean QTd (ms)	85.4 +/- 33.3	131.5 +/- 31.8	.0012

Conclusion
Prolongation of the QT, QTc, and QTd are the most consistent (100%) changes during transmural ischemia induced by balloon inflation during PCI.

1110-221 **Registration of Cardiac Magnetic Resonance Images With Three-Dimensional Electroanatomical Mapping to Guide Catheter Ablation in the Left Ventricle**

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Background: During catheter ablation of post-MI ventricular tachycardia (VT), electroanatomical mapping (EAM) of the left ventricle (LV) is performed to delineate the myocardial scar. Cardiac MRI could facilitate these procedures by providing detailed anatomical information about myocardial tissue architecture. In the optimal scenario, a 3D MR image of the scarred LV would be registered with the EAM system to guide catheter movement to the infarct borders in a real-time fashion.
Methods: *In vitro* and *in vivo* experiments were performed using a custom workstation able to integrate 3D MRI datasets with real-time mapping data acquired with CARTO (Biosense-Webster). First, a plastic life-size model of the LV/aorta was used to determine the optimal LV registration strategy; MRI & EAM of this phantom was performed and the datasets were registered. Second, in order to determine the *in vivo* accuracy of the registration process, iron oxide was injected at 2-3 discrete locations within the LV of normal pigs (n=5). MRI defined the LV geometry and the locations of the injections. Then, after registering the 3D MRI and EAM datasets, ablation lesions were directed at the iron oxide "targets". Third, using a porcine model of healed MI (n=6), a catheter was manipulated within the registered LV and ablation lesions were targeted to the scar borders.
Results: Registration of the LV alone resulted in inaccurate alignment because of rotation along the LV long axis. When the aorta was included in the registration process, proper alignment was seen after acquiring only ~15 LV points. Based upon the iron oxide injections, the mean accuracy of the registered LV datasets was < 5mm. This registration was sufficiently accurate in the *in vivo* porcine infarct model to reliably guide the catheter to the LV apex and mitral valve annulus; furthermore, the ablation lesions were invariably situated at the scar borders.
Conclusions: These data support the hypothesis that registration of pre-acquired MR images with real-time mapping is sufficiently accurate to guide catheter navigation in the LVin a reliable and clinically-relevant manner.

POSTER SESSION

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Prediction and Measurement of Response to Resynchronization Therapy

Monday, March 08, 2004, 3:00 p.m.-5:00 p.m.
Morial Convention Center, Hall G
Presentation Hour: 4:00 p.m.-5:00 p.m.

1111-207 **Area of Left Ventricular Regional Conduction Delay and Preserved Contractility Predict Responses to Cardiac Resynchronization Therapy**

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Background—A significant proportion of patients with dilated cardiomyopathy and left bundle branch block (LBBB) do not respond to cardiac resynchronization therapy during left ventricular (LV) pacing. The purpose of this study was to investigate whether the electromechanical properties of the myocardium would predict acute hemodynamic improvement during LV pacing. *Methods and Results*-- We studied 10 patients with idiopathic dilated cardiomyopathy and LBBB (ejection fraction: 27±7%; QRS duration: 166±16 ms) using three-dimensional electromechanical endocardial mapping (NOGA, Biosense Webster) to assess endocardial activation and local linear shortening during sinus rhythm. LV stimulation was performed in VDD mode at 5 different sites and 3 atrioventricular delays within anterior and lateral branches of the coronary sinus. LV +dP/dt_{max} changes from baseline were measured during LV stimulation at each site ($\%dP/dt_{max}$). Among the population, there was no significant relationship between the maximum $\%dP/dt_{max}$ during LV stimulation at the best coronary sinus site and the conduction delay at the site (r=0.1, *P=0.52*), the total LV endocardial activation time (r=0.11, *P=0.76*), nor the baseline QRS duration (r=-0.08, *P=0.82*). The total area of LV endocardial surface was 14113±2924 mm^2 with % area of late endocardial activation time being 27±13%, and % area with preserved local linear shortening being 34±14.The maximum $\%dP/dt_{max}$ was significantly and positively correlated with % area of late endocardial activation time (r=0.97, *P<0.001)* and preserved local linear shortening (r=0.82, *P=0.004*), respectively. Muti-variate analysis showed that only percent area of late endocardial activation was independently correlated with $\%dP/dt_{max}$ (*P<0.05*). Patients with >20% of LV area with late endocardial activation time and >30% of preserved regional contractility had 5 times better acute hemodynamic response with LV stimulation. *Conclusion*—Maximum systolic enhancement with LV pacing is not dependent on the maximum conduction delay or QRS width. Rather, it is dependent on the presence of a larger amount of LV area with late endocardial activation time and preserved regional contractility.

1111-208 **Prevalence of Echocardiographic Left Ventricular Contractile Dyssynchrony in Patients With Left Bundle Branch Block: Impact on Selection for Pacing**

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Background – There is published evidence that cardiac resynchronisation pacing (CRT) reduces morbidity in patients with class III/IV heart failure, left ventricular ejection (LVEF) ≤35% and left bundle branch block (LBBB), width ≥150 ms. However, up to one third of patients selected by the above criteria do not respond as measures of electrical delay may not identify the mechanical abnormality that can be reversed by CRT. Conversely, patients with LVEFs >35% or QRS widths <150 ms may exhibit contractile dyssynchrony that may be helped by CRT.
Methods – We studied the echo features of LBBB (QRS ≥120 ms) in 48 heart failure patients referred for CRT (group A) and 42 patients investigated for chest pain (group B). Images were stored in an Enconcert (Phillips) digital archive for offline analysis. The 16 segment/4 grade LV wall motion score index, LVEF (biplane method of disks), interventricular preejection delay (IVPED) and number of segments with short axis contractile dyssynchrony were quantified.
Results – Group A had more breathlessness, wider QRS complexes, worse WMSI and lower LVEF than Group B. In these heart failure patients, LV dyssynchrony was seen, with an average of 5.4 segments showing paradoxical contraction, particularly in the apical 4 and 3 chamber views.

Mean±sd	NYHA	QRS(ms)	LVWMSI	LVEF%	IVPED(ms)
Group A	3.0±0.6	160±21	2.42±0.37	24.7±7.7	59.3±26.4
Group B	1.6±0.7	139±17	1.66±0.57	46.4±15.6	39.6±21.7
P value	<.0001	<.0001	<.0001	<.0001	0.0011

In all patients, a weak, inverse relationship was seen between QRS duration and LVEF. Dyssynchrony was only present when the LVEF fell below 45%. 33% of the patients with either LVEF>35% or QRS<150 ms had LV dyssynchrony in comparison to 81% of patients with both LVEF≤35%/QRS≥150 ms.
Conclusion – 1 in 5 patients meeting standard CRT selection criteria do not have mechanical dyssynchrony and may not respond to pacing. In contrast, 1 in 3 without these criteria may be eligible for pacing by echo-based criteria.